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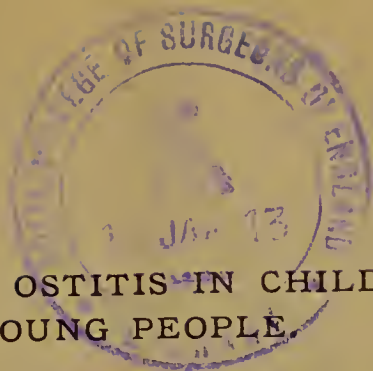
Acute Septic Ostitis in Children and Young People.

By EDMUND OWEN, M.B., F.R.C.S.,

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to and Lecturer on Surgery at St. Mary's Hospital, London.

LECTURES I. AND II.

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LECTURE I.

GENTLEMEN,—At different times and under different circumstances acute inflammation beginning at the end of a diaphysis has borne various names. Among these may be mentioned acute diffuse periostitis, infective periostitis, osteomyelitis, phlegmonous ostitis, diaphysitis, “acute necrosis,” and para-epiphysitis.

The disease, under whatever name it has been described, has always been recognized as an extremely serious one, and it is not unlikely that in many cases children have fallen victims to it without its nature having been suspected. Even at the present day there is often regretful delay in recognizing it, and valuable time is lost whilst the practitioner remains in the dark.

In May, 1862, Dr. Bristowe laid an important communication on the subject of acute ostitis before the Pathological Society of London. He began by alluding to “the acuteness, the danger, and the obscurity of the disease,” and remarked that the affection is not only deadly, but common. Of the seven cases which he had met with in four years, “five died speedily of pyæmia.” Three of the cases had been mistaken for “rheumatism,” and he called attention to the ease with which this error of diagnosis may be committed, especially when the pyæmic condition is associated with purulent pericarditis.

As I shall show later on, the diseases for which acute septic ostitis is mistaken are usually acute rheumatism and erysipelas. But, as Bristowe remarks, some of the symptoms bear “a superficial resemblance to those of typhus, typhoid, or even of delirium tremens.”

Among the *Memoires* of the Surgical Society of Paris, of the year

1857, appears one by Chassaignac upon "Acute Subperiosteal Abscesses and their Treatment." He regretted, at the outset, that these abscesses had been but little studied, and he affirmed that the principles on which they should be treated had not up to that time been duly formulated. Though Chassaignac's paper was read in the summer of 1853, I think that it may fairly be said that even at the present time the exact nature of these abscesses is not generally understood, and that their treatment is not undertaken with sufficient energy and despatch.

Since Chassaignac's time pathological investigation has thrown much light upon the subject, and although in certain particulars his teaching has, perforce, undergone considerable modifications, still his *Memoire* must always be regarded as one of the most important, as well as one of the very earliest, upon the subject.

First, as regards the title of the disease. The illustrious French surgeon said that, suggesting as he did the name of "acute subperiosteal abscess," he refrained from stating the origin of the suppuration; that the pus formed, generally with grave symptoms, in the course of a few days, but that as to whether its source was a superficial osteitis or a suppurative periostitis he was uncertain. We now know that it is neither. We recognize the disease as an acute septic inflammation of the end of a diaphysis, spreading in many cases through the whole of the diaphysis, and causing purulent effusion not only beneath the periosteum, but through the compact and cancellated bone and into the medulla.

Chassaignac pointed out that the acute subperiosteal abscess was but rarely found after the age of seventeen years; and, looking back, it is almost a matter of surprise that he did not offer a speculation as to the existence of some connection between this disease and the development of the long bones. But, as one reads his essay, one can scarcely help being struck with the solidity of his work: he accepts nothing but that of which he is absolutely certain; and although in one place he actually mentions the word "osteomyelitis," he declines, as we have already noted, to speculate on the origin of the pus which, locked beneath the diaphyseal periosteum, formed the subject of the *Memoire*.

As regards the influences which may predispose to the disease, Chassaignac laid great stress upon the "scrofulous constitution." In former days it was, no doubt, difficult to get away from the extremely comprehensive word "scrofulous." Its chief recommendation was, perhaps, its vagueness. Pathology, which is becoming every day more exact, now gets on much better without it. If scrofula means "tubercle," we make ourselves clear by calling it tubercle. The latter is a disease

associated in the mind of every practitioner with certain definite lesions. But if Chassaignae intended to convey the idea that these acute subperiosteal suppurations are often the result of tubercular infection, his opinion was probably different from that generally held nowadays.

The chief reason for the French surgeon attributing the causation of the disease to tubercle was, apparently, that several of the children who were attacked had already been the subjects of acute subperiosteal abscess. He evidently mistook pyæmia for tuberculosis,—a mistake the commission of which is by no means confined to his day. But he soon breaks away from the effect of his error by pointing out that there is by no means a necessary association between “serofula” and the disease which occupied him, for some of the children had enjoyed an excellent constitution. Yes, so it is; many of the subjects of septic otitis have been in the best of health until attacked by that disease.

In my experience it has by no means been the case that the victims of the disease have been picked out from the abject poor, from those of the most miserable physique, or from those who have an hereditary taint of tuberculosis. More often than not, the child has been playing about well and strong, has been at school, or has been engaged in light work until the moment that he is attacked. I use the masculine pronoun advisedly, for a considerable proportion of those coming under treatment are boys. In the *Memoire* attention is duly directed to this matter of sex in the rôle of the disease; out of the eleven cases then recorded eight were boys.

From tables which have been kindly prepared for this essay by Dr. Kellock, F.R.C.S., medical superintendent of the Hospital for Sick Children, Great Ormond Street, I find that in the ten years ending December 31, 1894, there have been one hundred and five cases of septic otitis admitted into that institution. Of this number sixty-three were in boys and forty-two in girls.

Mr. Crowle, F.R.C.S., the surgical registrar at St. Mary's Hospital, has also prepared for me a list of similar cases which were under his notice in the wards from 1881 to 1894 (inclusive). They make a total of sixty, of which thirty-three were in boys and twenty-seven in females.

Placing these figures with those just given, we get a total of one hundred and sixty-five cases, of which number ninety-six were in males and sixty-nine in females. I confess that I was not prepared to find so large a proportion of female subjects of the disease, the figures working out about five boys to three girls.

In these one hundred and sixty-five cases the femur was the bone

affected in eighty-three, the tibia in forty-seven, and the humerus in twenty. Next in order came the fibula; and in still smaller proportions came the radius, ulna, clavicle, and os calcis. The reason for boys being more often attacked than girls is that they are, in their work and play, much more exposed to kicks, blows, and injuries generally than girls are; and, as will be remarked immediately, some slight or severe injury is usually the determining cause of the onset of the acute inflammation.

At the seat of the injury the bacteria multiply rapidly and thus pyæmia occurs.

Predisposing Causes.—When it is considered that the one thing needful for the successful cultivation in the bone of the septic micro-organism of the disease is a lowered state of the vitality of the bone, it is easy to supply a lengthy list of predisposing causes. And these causes at once arrange themselves in two groups, the constitutional and the local.

Foremost among the constitutional causes may be placed that general feebleness of tissues which is the result of the faulty hygiene in which so many of the children of the poor and of the lower middle class are placed. And as this group of children includes the under-fed and ill-fed, as well as those who are insufficiently clothed, the field of selection must evidently be a large one. To these general predisposing causes must be added those illnesses and conditions which are specially likely to attack children and growing boys and girls and to leave them enfeebled. Thus, typhoid and scarlet fever, measles, influenza, bronchitis, fatigue, and exposure to wet and cold play an important part in preparing the unhappy child for the attack.

Among the local causes must be enumerated blows, kicks, falls, sprains, and injuries of all sorts. And seeing how many poor and ill-nourished children there are around us who are forever exposing themselves to injuries, it is almost a matter of surprise that acute osteitis is not more frequently met with. Probably the explanation of the comparative rarity of the disease is that at the particular time at which the injury is received the child's blood-stream happens to be destitute of those particular micro-organisms whose seizure upon and cultivation in the bone constitute the disease in question.

The Micro-Organisms.—That the disease known as acute septic osteitis or osteomyelitis is actually the direct result of the cultivation of certain germs in the delicate osseous tissue there is, I think, little room for doubt. Professor Cornil and Professor Babes, in their excellent work upon the pathology of disease due to the presence

of micro-organisms,¹ state (vol. i. p. 498) that the microbes obtained from a case of septic osteomyelitis and cultivated through a series of generations, which were continued throughout an entire year, produce a similar disease in the lower animals. They conclude by saying that there is no parasitic disease of which the exact nature has been better determined than that of septic osteomyelitis.

Pasteur, Babes, and others, who have made cultivations of the micro-organisms of the disease, agree that the very head and front of the offending in this form of osteomyelitis is the *staphylococcus pyogenes aureus*. It can be reproduced on needle-point thrusts in gelatin from generation to generation, and when inoculated into one of the lower animals—especially if a bone has been previously prepared by a slight injury—it produces again acute septic osteomyelitis. But in those instances in which injections of the cocci have not been preceded by any injury to the bone, acute suppuration has occurred at the seat of the injection. After the death of the animals septic inflammation is found in the liver, the kidneys, the joints, and elsewhere, and even from the blood itself cultures of staphylococci have been made. Indeed, the evidence appears overwhelming that the osteomyelitis in question is due to the presence of constant and extremely virulent staphylococci, and that the local condition runs hand in hand with pyæmia.

In connection with the highly septic nature of these cases, I may remark that on one occasion I was seeing with a late house-surgeon of St. Mary's Hospital, Mr. Edgar Morgan, a child with a small and very acute subperiosteal abscess at the upper end of his tibial diaphysis. The pus was locked up under considerable tension; the abscess was very hard and devoid of fluctuation. On thrusting a scalpel into it the contents were voided with so much violence that some of them fell on my right wrist, whilst some were ejected into Mr. Morgan's face. We trephined and washed out the diseased bone, inserted a drain, secured the limb on a splint, and forgot all about the ejection of the pus. About three days afterwards I was lecturing in the Medical School of St. Mary's Hospital on surgical diseases due to the inoculation of septic micro-organisms, and it suddenly struck me that three pustules which I then had developing on the back of my right wrist were due to my being the unconscious and unwilling subject of an inoculation-experiment of the micrococci of acute osteomyelitis. I therefore made the sore the subject of some clinical remarks, asking

¹ Les Bactéries et leur rôle dans l'Étiologie, l'Anatomie, et l'Histologie pathologiques des Maladies Infectieuses. Paris: Germer Baillière et Cie., 1890.

the class at the same time if they had heard anything of the house-surgeon who had received some of the septic fluid in his face. No one had heard of him. But a day or so afterwards I was informed that he had been laid up with a serious attack of purulent conjunctivitis, for the cause of which he had been able in no way to account. As soon, however, as he heard that I had been inquiring after him, he remembered the incident to which I had referred in my lecture.

The surgeon cannot be too careful in his dealing with these cases. The disease is truly infective,—that is to say, if any of the septic micro-organisms gain admission into his tissues, they may go on developing after their kind and may eventually involve him in a general pyæmia. It is due to their presence that a scratch on the finger received whilst removing a sequestrum from the limb of a child or of a young adult is so apt to end seriously. A surgical friend of my own permanently lost the use of his left index-finger from a prick received under such circumstances, and it is probable that if similar, and, perhaps, more serious, calamities could be investigated in the light of modern science, and on the lines here suggested, their exact nature would be rendered clear and intelligible.

As to the way in which the germs manage to reach the delicate, growing tissue at the end of a diaphysis it is, in most instances, impossible to say. It may be that in certain cases they enter the capillaries of the mouth, naso-pharynx, pharynx, or of the respiratory tract or alimentary canal. Sometimes they have been received through a septic wound near or remote from the region of osteal attack. But I doubt if they often if ever pass straight from skin to diaphysis. The improbability of the micro-organisms reaching the end of the diaphysis straight from a skin-wound seems obvious in the case of the disease affecting the deeply-placed ends of the femoral diaphysis. The fascia lata would prove a terrible Rubicon, to say nothing of the mass of muscles and the capsule of the hip-joint in the case of the disease affecting the upper end of the femoral diaphysis.

The starting of the disease is the soft, new bone-tissue which has most recently been deposited at the end of a diaphysis. Being the most delicate part of the bone, it is most likely to suffer from a blow, a strain, or other injury, and it offers to the micrococci a highly suitable medium for cultivation. But the micrococci of pus-producing disease are not the only germs which select this delicate tissue. The bacilli of tuberculosis affect it with almost equal readiness, as in the case of spinal caries, and in many instances of joint-disease.

That this tissue is the favorite though not necessarily the only

starting-point of septic osteitis is shown by the fact that the tenderness, the redness, and the pain are almost invariably referred to the end of the diaphysis. "Just below the knee," "just above the ankle,"—how often these expressions occur in the history of the disease. And if the surgeon is prompt in operating he may find the disease entirely limited to that part of the bone. Too often, however, he discovers that the bone is invaded to a considerable distance from the junction-cartilage. But even then he finds that the effects of the storm are most marked towards the very end of the diaphysis. And in many cases he detects a small sequestrum lying close against the junction-cartilage. Time after time, in operating, have I picked out a sequestrum of the size of a pea, or of a bean, from the end of a diaphysis. In that particular spot of bone the chief fury of the storm was spent, and the surgical operation was completed by removing this sequestrum and scraping out and disinfecting the adjacent bone-tissue.

It has sometimes been a matter of surprise to me that, with so intense an inflammation at the end of a diaphysis, the neighboring epiphysis should have entirely and permanently escaped infection. It must be remembered, however, that a diaphysis has, to all intents and purposes, nothing to do with the epiphysis. The two elements of the bone are perfectly separated by the junction-cartilage, and each has its own system of blood-vessels. Indeed, the diaphysis of the tibia is almost as distinct from the epiphysis as if the two parts were different bones.

As a matter of fact, in a considerable proportion of cases the invasion of streptococci is not confined to the diaphysis, but, traversing the junction-cartilage, they swarm through the epiphysis and wreck the joint. This serious condition is, I think, more often met with in the case of infants than of older children. Indeed, of so frequent occurrence is the invasion of the joint a result of acute para-epiphysitis occurring on the threshold of life that Mr. Thomas Smith described the condition some years ago in a paper in the reports of St. Bartholomew's Hospital, under the title of "Acute Arthritis of Infants." In some such cases the acute septic osteitis no doubt begins in the epiphysis, but, as a rule, the trouble starts, I should maintain, as a para-epiphysitis, as an inflammation near to the epiphysis, a localized diaphysitis. The following report of a child who came under my care at the Hospital for Sick Children illustrates this point extremely well.

CASE.—A male child of twenty-five months was admitted June 3, 1892, in a state of extreme exhaustion. The mother said that about a fortnight before it had a series of fits, and that on June 2 she had

noticed that both of its shoulders were swollen. He was extremely ill and anæmic; the temperature was 104.4° F. The shoulders were red and tense, and fluctuation could be obtained in them. We diagnosed acute septic diaphysitis; and within an hour of his admission we had him in the theatre and under chloroform. I dealt with one side and the surgical registrar with the other. We opened and irrigated the joints, resected the softened epiphysis, and scraped away the diseased end of the humeral diaphysis. On one side a small sequestrum was removed from the end of the diaphysis, and on the other side the end of the diaphysis was surrounded by pus and septic granulation-tissue. The child made a complete and rapid recovery, and was eventually found to have useful and freely movable, though shortened, arms. On each side, so far as we could make out, the disease had begun at the end of the diaphysis, and expended itself upon the epiphysis and the joint rather than on the shaft of the bone. The anæmic and serious condition of the child at the time of his admission, the history of "fits," and the symmetrical distribution of the lesions point most markedly to the pyæmic nature of his disease. He was apparently rescued from death by the double resection, and the report shows once more the importance of prompt and vigorous treatment in every case, however unpromising the outlook may be.

Certainly the disease under consideration is not merely a periostitis, for so acute an inflammation of that tissue could hardly fail to destroy it by gangrene; yet it does not slough. On the contrary, in those cases in which the entire diaphysis, or a part of it, is promptly lifted out from the subperiosteal abscess by which it is surrounded, the periosteum quickly resumes its bone-forming office.

The periosteum is usually involved only to this extent,—that it is hyperæmic, thickened, and œdematous. But so also are the adjacent muscles and fasciæ, as is duly observed as the surgeon cuts down upon the bone. Even the skin over the inflamed tibia, for instance, is thick and œdematous.

The terms applied to the disease by the older pathologists show that they considered that it was primarily a periostitis. The general and local signs apparently justified that view, and the evidence in that direction seemed conclusive when they found the membrane separated from the bone by extensive suppuration. To them it appeared far more probable that the pus came from the periosteum than the bone. If it had struck them that the disease rarely, if ever, occurred after the completed development of the bone, and if they had noticed that the growing bone had, in many cases, borne the chief shock of the

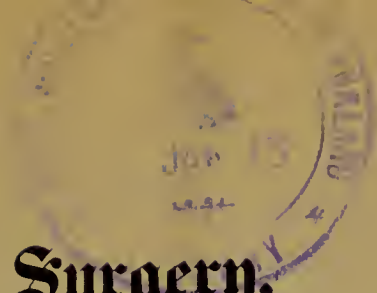
inflammation, the exact nature of the disease would long since have been cleared up. Chassaignac, however, dealt with this part of the question with equal caution and candor. He said that he would not accept the theory suggested by the word periostitis, because he did not know whether the trouble came from the bone or its covering; he would call the condition acute subperiosteal abscess, a denomination which had at least the merit "*de ne rien préjuger sur la nature et la mode de formation de la collection purulente.*" As Cornil and Babes remark, the disease is characterized by a diffuse suppurative inflammation which exists in all parts of the growing bone,—under the periosteum, in the superficial layers, in the mass of the bone, in the marrow, or at the level of the epiphyses. So rapid is the advancement of the disease that, according to these pathologists (to whose writings on the pathology of the disease I am much indebted), pus may be found beneath the periosteum within twenty-four or forty-eight hours of the beginning of the illness. There is purulent infiltration of the ends of the diaphysis and of the marrow; the Haversian canals are blocked with pus, septic nephritis occurs, together with grave constitutional symptoms, and the disease is "constantly mortal."

I venture to think that, as regards the mortality of the disease, our illustrious French and Hungarian colleagues have erred upon the side of pessimism. And the explanation of this may possibly be due to the fact of their respective pathological laboratories being far removed from the hospital wards, and that, for the most part, only the unfortunate victims of the disease have fallen beneath their notice. Speaking metaphorically, it is a matter for regret in practical medicine and surgery when the mortuary and the pathological laboratory are far removed from the wards. Pathology should not be studied as a separate science, but as a part of medicine and surgery.

Symptoms.—A little further on I have said so much in connection with the symptoms of the disease (whilst discussing its differential diagnosis) that I need not enter upon them very fully here. Probably the first indication of there being anything amiss with the boy will be a complaint of his feeling aches and pains (rheumatic) near some joint in the lower extremity. Very likely this is during convalescence from some serious disease; perhaps after the receipt of some disregarded injury, or after exposure to wet or cold or to unusual fatigue. The limb swells; and if the bone is not too thickly enshrouded in muscle, the skin becomes hot, red, and œdematous. If the medical attendant then examine it (as he should do) he would find a central and exquisitely tender enlargement. This is periosteal. It cannot be actually

in the bone, for osseous tissue does not become swollen after a few days' inflammation. The pains steadily increase. The boy cannot sleep, his temperature rises to 103° or 104° , or even higher; maybe, if very young, he has a convulsion; if older, he may have a shivering attack or a genuine rigor. The boy is evidently ill; and, in all probability, he is delirious at night, because of his brain being poisoned by the absorption into his blood of the products of decomposition at the septic focus. Suppuration takes place, and very likely some other diaphysis becomes affected, or a pyæmic abscess forms in some other part of the body. Possibly septic pneumonia, pleurisy, or pericarditis supervenes, and, quickly or slowly, he sinks unconscious and exhausted.

The treatment, the differential diagnosis, and the complications of the disease will be dealt with in a subsequent contribution.



Surgery.

THE TREATMENT, COMPLICATIONS, AND DIFFERENTIAL DIAGNOSIS OF ACUTE SEPTIC OSTITIS IN CHILDREN AND YOUNG PEOPLE.

CLINICAL LECTURE DELIVERED AT ST. MARY'S HOSPITAL.

BY EDMUND OWEN, M.B., F.R.C.S.,

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LECTURE II.

GENTLEMEN,—In the matter of the treatment of acute septic ostitis in children there are two elements of prime and of equal importance. They are promptitude and thoroughness.

In dealing with a simple acute abscess in the ordinary way the surgeon is apt to say to himself, "As I am not quite sure as to the presenee of suppuration I will wait a while;" and so he delays speculative interference,—it may be for some hours, it may be for a day or two. I do not defend such Fabian tactics; far otherwise. But I know that there are some surgeons who would deem their art actually discredited if they cut into inflammatory tissue in search of pus and failed to discover any. It may be that in the ordinary run of unimportant surgical inflammations no great harm is entailed by such delay. But in the case of acute inflammation of a diaphysis such cautious tactics are deplorable. During the time that is lost the staphylococci are developing at a terrible rate; they are diffusing themselves along the bone tissue and marrow, causing septic thrombosis through the entire diaphysis, perhaps. These unchecked and devastating germs are determining a purulent exudation beneath the periosteum, and not only are they involving the diaphysis in an inevitable necrosis, but they are subjecting the unhappy patient to needless agony and to the terrible and hourly increasing risks of fatal pyæmia.

Immediately on seeing a patient with diaphysitis the limb should be thoroughly cleansed, for the presence of foulness within must not be taken as rendering external asepsis superfluous. The patient being

under an anæsthetic, a free incision should be made through the periosteum of the affected area and down upon the bone. This proceeding either does, or it does not, evacuate a subperiosteal abscess. Assuming that it does reveal the presence of suppuration, the surgeon should freely open up the cavity and as quickly as possible wash it out with a hot solution of mercuric perchloride,—one in two thousand. Then he should see what extent of the diaphysis is bare; and he may be quite sure of this, that the length of bone denuded is not equal in extent to that of the bone in which the vessels are in a condition of septic thrombosis.

If the chief part of the diaphysis is bare both in length and circumference, the probability is that that piece will necrose bodily. But by good fortune it may not do so, especially if the tension has been quickly relieved. I have met with an instance in which I could pass a probe completely round the bare tibial diaphysis of a boy in a considerable extent of its length; yet, after thorough irrigation and drainage, the periosteum in due course became again adherent, and no necrosis supervened.

If on opening the abscess the diaphysis be found denuded of periosteum, and one of its ends be detached by suppuration from the epiphysis, there can, I think, be little chance of its surviving. It is better, then, to resect the denuded part of the bone forthwith, and to hope for the regeneration of a diaphysis from the periosteum. And such an occurrence is by no means unlikely to happen.

If both ends of the denuded diaphysis be detached, there can be no doubt as to the advisability of lifting it bodily from the subperiosteal bed of pus in which it is lying. Possibly amputation may, however, be deemed the better alternative in certain instances.

I freely admit that the treatment here advised may in some cases be followed by failure; that the periosteum does not resume its osteogenetic function; that the limb remains useless, and that amputation has eventually to be resorted to after much disappointment and delay. But when this treatment succeeds it is extremely successful; and when it proves disappointing it is pretty certain that less radical measures would not have achieved a better result. Indeed, I have witnessed the occurrence of necrosis in so many of these cases that I am convinced that we err upon the side of doing too little rather than doing too much in the treatment of osteomyelitis.

The great advantage of the treatment by resection is that it effects the prompt removal of the medium in which the cultivation of the cocci is taking place. And if it is efficiently done, and if the surround-

ing tissues are thoroughly washed by a germicidal lotion, there is practically an end to the disease. Of course, there is a risk of the ablation being carried out with superfluous energy; that some bone tissue is removed which is not infected with germs. But, after all, this does not amount to much; "yet better the excess than the defect."

The same objection has been raised against the treatment of carbuncle by resection and scraping. But no one, I think, who has watched the progress of cases of carbuncle which have been dealt with after this manner can have two opinions as to its value.

I do not wish to insist that in every case of septic diaphysitis with a loosened epiphysis the resection treatment can be carried out; but in most cases it can. Probably if the lower end of the femoral diaphysis were bare and detached, amputation might in many instances be preferable. The value of the femur for the purposes of support and progression would be so seriously interfered with by the operation of partial resection that there is much to be said in favor of amputation.

In those cases in which the diaphysis is bare and its continuity with the epiphysis persists, resection is scarcely to be adopted, for, as we have seen, necrosis is not inevitable, though it is probable. In such circumstances it is advisable to lay the shell of compact tissue freely open, and to scrape out the septic marrow and the cancellated tissue. After this, the hollowed bone is to be washed out with hot mercuric solution, one in three thousand, and gently dressed with mercuric gauze, the limb being carefully fixed in a splint and raised on a pillow. By these measures the intra-osseous tension is effectually eased, and the septic foci are cleared away, with the twofold advantage of diminishing to the utmost the risk of extensive necrosis and of pyæmia. Without question there are a large proportion of cases of septic osteitis for which on their admission into the hospital no treatment short of amputation can be recommended.

The indications for amputation cannot be concisely and definitely formulated; each case must be considered by itself. Exhaustion, high temperature, rigors, and delirium do not by themselves establish the expediency of amputation; grave as these symptoms are, they are usually associated in every severe case. Nor, among the local signs, are great swelling of and tenderness in the part, extensive subperiosteal abscess, and detachment of an epiphysis to be taken as affording that indication, for they coexist in many a case in which a useful limb is eventually preserved. Nor does the conjunction of these two groups of general and local signs necessarily demand amputation.

In the case of the disease extending into and causing acute suppu-

ration of the neighboring joint, it is generally expedient to amputate. But even in these circumstances resection may sometimes be successfully resorted to. I reported two such cases before the Medical Society of London some years ago.

In the later stages, when the disease has been allowed to drift on until the end of a bare diaphysis is making its way through a mass of granulation tissue, and the boy is worn out by long-continued suppuration, it is better to remove the limb forthwith. In such a case the periosteum is likely to be wholly replaced by granulation tissue, so that even if a large sequestrum were lifted out there would be little likelihood of a new diaphysis being formed. Thus, temporizing would lead to disappointment, and an inevitable amputation would be unfortunately postponed. For the regeneration of a diaphysis, or of part of one, early resection of the infected bone is necessary.

When two or more bones are affected it may be expedient to amputate that which was the seat of the original disease, and to temporize, may be, with the other. But amputation of a single limb by no means suffices for the successful issue of all these serious and pyæmic cases.

The fact of a boy having well-marked pyæmia is not of itself an indication that the primary seat of septic disease should be removed by amputation, though, doubtless, in many cases amputation offers the safest course. As I said just now, each case must be taken on its merits. Pyæmia and metastatic abscesses appearing shortly after the primary manifestation are much more likely to demand amputation than are similar conditions appearing later in the progress of the case.

I have at the present time under my care at St. Mary's Hospital (February, 1895) a boy of thirteen years, whose illness began a little more than a year ago with acute para-epiphysitis in the lower end of the left femur. We cut into the bone through the interval between the ilio-tibial band and the tendon of the biceps, removing a central sequestrum from the end of the diaphysis, and clearing away much septic granulation tissue. Within a few weeks the boy had severe constitutional disturbance, and acute diaphysitis manifested itself at the upper end of his right humerus. This was also dealt with by scalpel and gouge, and everything went on well, though the femoral wound did not heal. Some months afterwards he again came into the hospital and more sequestra were removed from the thigh. The wounds had entirely healed when he had a further disturbance, acute synovitis appearing in the opposite knee, and intra-articular suppuration ensuing. This pyæmic abscess was treated by free incision and mercuric irrigations, and he is now convalescent. It is, I trust, the last of his troubles.

Indeed, I should think that the boy's blood has been so fully leavened with the toxines elaborated by the cultivation of the micrococci that he is now proof against further infection. Very different is this form of pyæmia from that which sometimes appears in the early weeks of septic osteomyelitis. In the latter case the dose of toxine cast into the blood-stream not only paralyzes the nerve-centres, but it may be so potent that the patient, unable to eliminate it, sinks beneath its fatal influence.

Complications.—The commonest and the most serious complication of acute septic ostitis is, without doubt, pyæmia. Indeed, I would not dispute the contention that these cases are essentially and from the beginning pyæmic; certainly the constitutional symptoms are those of pyæmia, and it is only a question as to the entrance of the staphylococci into the blood-stream, and the establishment of secondary foci of sup-puration, as to whether or no the general signs of infective blood-poisoning shall be manifested. In some cases the septic intoxication is so acute that the subjects perish almost at the onset; at any rate they do not live long enough to give manifestations of the infective form of the disease. In other cases the children struggle bravely through the acute stage of pyæmia to fall victims to a lingering form of that disease, or to exhaustion, hectic fever, or albuminoid disease of blood-vessels and of the viscera.

One of the most likely complications of the para-epiphysitis is extension of the disease into the neighboring articulation. In the case of the primary disease attacking the upper end of the femoral diaphysis, implication of the hip-joint is almost inevitable, for the simple reason that the end of the diaphysis is included within the capsule. But in the case of a diaphysis being inflamed near a shoulder, knee, or ankle, the pus would have to burrow into the joint. This it may accomplish in one of two ways,—either by transversing the junction cartilage and epiphysis, or by creeping thither beneath the periosteum of the epiphysis. Of both examples I have met with various instances. At one time I had under my care in the same ward two children into whose knee-joints the pus had made its way direct from the seat of septic infection. In one case the pus had effected its entrance by working its way through the head of the tibia, and in the other by passing beneath the periosteum and the capsule. In each case the invasion was signalled by an attack of acute arthritis, but a resort to immediate resection of the joint and a radical dealing with the septic bone was the means of saving each limb.

Differential Diagnosis.—The two diseases with which septic diaphy-

sitis is most often confounded are acute rheumatism and erysipelas. Of the two errors the former is by far the more common. I have known accomplished and experienced physicians to fall into this error, and if I may be allowed to sketch a clinical outline of a case likely to mislead, it will be seen that almost any practitioner might go wrong over it. For instance: A boy of ten years is playing about in the beginning of a thaw, sliding and snow-balling. He comes in with his boots and trousers wet through. There is nothing remarkable in this; but it so happens that within a week of that occurrence, probably because of it, staphylococci begin to cultivate themselves in the lower end of his femoral diaphysis. He complains of pains about his knee, which his mother attributes to "rheumatism." (Most mothers consider themselves able to treat as well as diagnose "rheumatism.") She puts the boy to bed and foment the knee. He gets steadily worse. In two days she sends for the doctor because, as she says, her boy has "rheumatic fever." The boy is evidently feverish. The doctor takes his temperature; it is 103° to 105° F. The skin about the knee is flushed and burning hot; there is swelling near the joint, and there is so much tenderness close above it that the boy will scarcely let the doctor examine it, and he begs for the fomentation to be reapplied at once. Next day the boy is worse; he has not slept an hour; his temperature is a degree higher; he had a rigor during the night, and was "wandering;" moreover, he has now acute septic inflammation at the other shoulder, and, perhaps, some pyæmic pericarditis. My opinion is that almost the only man who would not be misled by such symptoms is he who realizes the fact that septic diaphysitis is a very serious, acute, and common disease with children. And he, by gently pinching the femur between his finger and thumb, would find that the disease was in the *bone*, and not in, though very close to, the joint. And if then, under an anæsthetic, he could not detect pus, he would immediately expose the bone through the groove between the ilio-tibial band and the biceps tendon, and explore or trephine for abscess.

Septic diaphysitis is not very often taken for erysipelas. Yet this error is now and then committed. Each is an infective blood-disease, and when the diaphysis concerned is superficial, as in the tibia, for instance, the extreme local swelling and the marked redness of the skin may, with the background of general symptoms, lead to error. But here again a gentle pressure of the diaphysis between the finger and the thumb would show that the swelling and tenderness were evidently in the bone and periosteum, and not in the bright red skin.